UCLouvain

lphys2101

2020

Analog and digital electronics

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

10 credits	45.0 h + 45.0 h	Q1

Teacher(s)	Cortina Gil Eduardo ;Piotrzkowski Krzysztof ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	This teaching unitis designed to familiarize the student with the basic aspects of electronic equipment in modern metrology. It is divided into two parts. The first part deals with the essential points of linear electronics in semiconductors and small signals. The second part is dedicated to an introduction to digital electronics and data acquisition systems. Both parts should be followed in parallel and the links between these two parts will be done during practical work and during a personal project.
Aims	**a. Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)** AA1: A1.1, A1.5 AA2: A2.5 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : 1 1. describe the operating mode of the basic electronic, analog and digital components and its limitations ; 2. simulate with LTSPICE software the response of the basic electronic circuits ; 3. analyze and calculate the basic assemblies commonly used in physics in the reading of sensors / detectors ; 4. analyze and draw a finite state machine ; 5. link an electronic data acquisition system to the computer using a simple communication protocol. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** The evaluation is based on : Analog Electronics • -Laboratory reports (25%) ; • Written exam : 5 or 6 questions + 3 problems (25%) ; Digital Electronics • Exercices during lectures (25%) • Presentation of an acquisition project : oral questioning (25%). Depending on the sanitary conditions the evaluation methods would be adapted to non-presential examinations.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Traditional lectures and exercises : - lectures ; - problem solving in audience. Directed practical work. Analogue electronics (obligatory) : - experimental study of basic circuits ; - LTSPICE simulation of circuits ; - report after each session. Project : developing an acquisition system with an FPGA or RaspberryPi : - implementation of a serial reading protocol (type I2C, USB, ...) ; - tutorials provided by teachers / assistants.

Content	Analogue electronic part. 1. Electronic simulation tools LTSpice-IV. 2. Analysis of passive circuits composed of linear and permanent elements. 3. The semiconductor diode. 4. The bipolar transistor. 5. Unipolar transistor or FET with field effect. 6. Differential amplifier. Operational amplifier. 7. Transmission lines. 8. The noises. Part dedicated to numerical electronics and data acquisition. 1. Digital and analog signals and systems. 2. Number systems, operations and codes. 3. Logic gates and gate combinations. 4. Combinational logic : adders, decoders, comparators, multiplexers, … 5. Sequential logic : flip-flops, timers, shift registers, counters, … 6. Counters : finite state machines. 7. Programmable logic : VHDL. 8. Data transmission. 9. Signal conversion : ADC, DAC, … 10. Buses and interfaces : serial and parallel buses, USB, I2C, ethernet.
Bibliography	1. Electronic Principles, A. Malvino & D.J. Bates, McGraw Hill (2007). 2. Microelectronic circuits, Sedra & Smith, Oxford University Press (2004). 3. Digital Fundamentals, 11th Edition (http://www.pearsonglobaleditions.com/Sitemap/Floyd/), Thomas Floyd, Ed. Pearson. 4. Acquisition de Données. Du Capteur à l'Ordinateur, Georges Asch et collaborateurs, Ed. Dunod.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Master [60] in Physics	PHYS2M1	10		
Additionnal module in Physics	APPHYS	10		
Master [120] in Physics	PHYS2M	10		